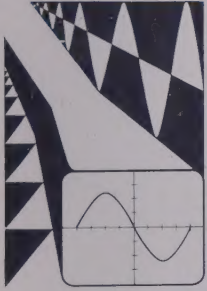


PHILIPS



Portable Two Channel 120MHz Oscilloscope
with Digital Delay

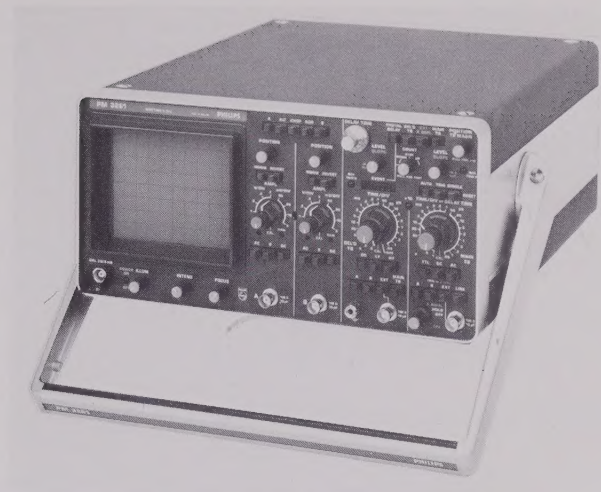
PM3261

9499 440 15911

760820/1/01/02



PHILIPS



Manual

Portable Two Channel 120MHz Oscilloscope with Digital Delay PM3261

This insert must be used
with the manual of the
basic PM 3260 oscilloscope



Order no. of
the insert
9499 440 15911

760820/1/01/02

The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.

Contents

1. GENERAL INFORMATION

- 1.1. Introduction
- 1.2. Characteristics

2. DIRECTIONS FOR USE

- 2.1. Installation
- 2.2. Function of the controls and the connectors.
- 2.3. Preliminary settings
- 2.4. Operating instructions
- 2.5. Full five-digits display modification

3. PROVISIONAL SERVICE DATA

- 3.1. Adjusting the digital delay section

1. General information

1.1. INTRODUCTION

The PM 3261 is a standard PM 3260 oscilloscope, but provided with:

- delayed time-base with pulse counting (digital) delay
- TTL triggering for the main time base.

The pulse counting delay can be selected to any value (1 to 9999). The delayed time-base is triggered by the pulse which is shown in the display.

The number of pulses to be counted is selected by a up/down count control knob, and is shown on a four-digit seven-segment led display.

For the rest the PM 3261 is equal to the PM 3260 featuring the measurement of signals at a high sensitivity (5 mV/DIV) over a large bandwidth (120 MHz).

Except the digital delayed time-base also the normal delayed time-base modes can be used.

The oscilloscope is provided with many thin-film integrated circuits, which guarantee a very stable operation and reduce the number of adjusting points.

There is a wide choice of display modes, such as one channel, two channels (alternately or chopped), two channels added with normal and inverted positions for both input signals.

The low-dissipation power supply works on any a.c. or d.c. voltage between 100 V and 240 V, thus obviating the need of adjusting the instrument to the local mains voltage.

All these features make the oscilloscope suitable for a wide variety of applications for the analog - as well as for the digital field of use.

If desired, the pulse counting delay circuit of the delayed time-base can be changed, to obtain a maximum of 99999 pulses to be counted. For further information on this modification refer to page 27.

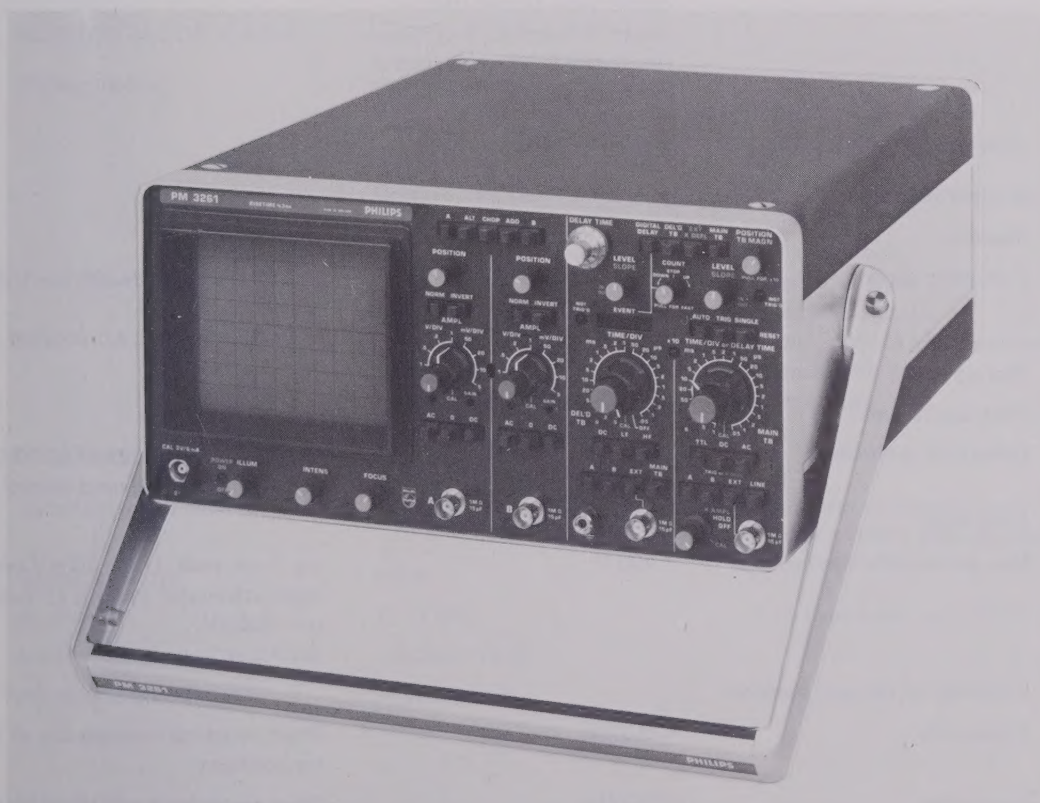


Fig. 1.1. Portable two channel 120 MHz Oscilloscope with digital delay PM 3261

1.2. CHARACTERISTICS

This specification is valid after the instrument has warmed up for 30 minutes.

Properties expressed in numerical values with tolerances stated, are guaranteed by the manufacturer.

Numerical values without tolerances are typical and represent the characteristics of an average instrument.

This instrument has been designed and tested in accordance with IEC Publication 348 for Class I instruments and has been supplied in a safe condition. The present Instruction Manual contains information and warnings which shall be followed by the purchaser to ensure safe operation and to retain the instrument in a safe condition.

Designation	Specification	Additional information
C.R.T.		
Type	PHILIPS D14-240	Rectangular tube face, domed mesh type, post-accelerator, metalbacked phosphor.
Measuring area	80 mm x 100 mm	Divided in 8x10 divisions
Screen type	P31 (GH) phosphor	P7 (GM) phosphor optional
Photographic writing speed	> 1500 cm/ μ s	Measured with Steinheil Oscillophot M5 camera Aperture: 1:1,2 Object to image ratio 1:0,5 Film: Polaroid 410 (10000 ASA) No pre-fogging Phosphor type P31 (GH)
Total acceleration voltage	19 kV	
Graticule	Internal	Continuously variable illumination
Engravings	Centimetre divisions with subdivisions of 2 mm along the central axes. Dotted lines indicate 10 % and 90 % of measuring lattice for measurement of rise time.	
VERTICAL OR Y AXIS		
Number of channels	2	A and B
<i>Response</i>		
Frequency range	d.c. ... 120 MHz 10 Hz ... 120 MHz	— 3 dB upper bandwidth limit, d.c. coupled — 3 dB bandwidth, a.c. coupled
Rise time	≈ 3 ns	
Pulse aberrations	± 3 % (4 % peak-to-peak)	
Deflection coefficients	5 mV/DIV ... 2 V/DIV	Nine calibrated positions in 1-2-5 sequence. Uncalibrated continuous control 1: $\geq 2,5$
Error limit	± 3 %	
Max. permissible input voltage	± 400 V	d.c. + a.c. peak. Up to 20 mV position of input attenuator derating at frequencies over 500 kHz. See Fig. 1.2.
<i>Instability of the spot position</i>		
Trace jump	< 0,3 Div.	When switching between any of the attenuator positions
Trace jump	< 0,3 Div.	When switching the NORM/INVERT switch.

Designation	Specification	Additional information
Trace shift	$< 0,3 \text{ Div.}$	When rotating the continuous attenuator.
Trace shift	$< 1 \text{ Div.}$	When switching to the ADDED position.
Temperature drift	$< 60 \mu\text{V}/^\circ\text{C}$	Typical value.
<i>Maximum deflection</i>		
Undistorted	24 divisions	
Shift range	16 divisions	8 divisions each in topward and downward direction reckoned from the central horizontal graticule line.
<i>Input impedance</i>	1 MOhm//15 pf	
<i>Input RC time</i>	$\geq 17 \text{ ms}$	Coupling switch to AC
<i>Visible signal delay</i>	Approximately 30 ns	
<i>Display modes</i>	Channel + or – A only Channel + or – B only Channels $\pm A$ and $\pm B$ chopped Channels $\pm A$ and $\pm B$ alternate Channels $\pm A$ and $\pm B$ added	
<i>Chopper frequency</i>	1 MHz	
<i>Cross-talk between channels</i>	1:500	2 divisions of signal amplitude at 50 MHz on one channel set to .2 V/DIV Cross-talk is measured on other channel set to 20 mV/DIV
<i>Common-mode rejection factor</i>	100 at 100 kHz 100 at 2 MHz 20 at 50 MHz	Measured with + A and – B added; max. common mode signal 8 divisions

HORIZONTAL OR X AXIS

<i>Display modes</i>	Main time base Main time base with intensified delayed time base after normal delay time, or digital delay. Delayed time base X-Y	After normal delay time, or digital delay. X deflection by: – Channel A signal – Channel B signal – Signal applied to EXT connector of main time base – Line voltage
----------------------	--	---

X DEFLECTION VIA CHANNEL Y_A OR Y_B

<i>Deflection coefficient</i>	5 mV/DIV ... 2 V/DIV	Uncalibrated continuous control $\geq 3:1$ via X AMPL potentiometer
<i>Coefficient error</i>	$\pm 5 \%$	
<i>Bandwidth</i>	0 ... 2 MHz	– 3 dB bandwidth over 8 DIV
<i>Input impedance</i>	1 MOhm//15 pF	
<i>Phase difference</i>	3° at 100 kHz	

Designation	Specification	Additional information
External X deflection via EXT socket		
<i>Deflection coefficient</i>	200 mV/DIV	One calibrated position Uncalibrated continuous control $\geq 3:1$
<i>Bandwidth</i>	0 ... 2 MHz	– 3 dB bandwidth over 8 DIV
<i>Input characteristics</i>	Identical to Y channels	
<i>Phase difference</i>	3° at 100 kHz	
<i>Max. permissible input voltage</i>	± 400 V	d.c. + a.c. peak. Derating at high frequencies; see Fig. 1.2.
X deflection with internal voltage at line frequency		
The deflection depends on the line voltage and has been factory-adjusted to 8 DIV at a line voltage of 220 V.		
MAIN TIME BASE		
<i>Time coefficients</i>	1 s/Div ... 50 ns/Div	Twenty-three calibrated positions in 1-2-5 sequence. Uncalibrated continuous control 1: $\geq 2,5$ between the steps
<i>Coefficient error</i>	± 2 % ± 3 %	+ 20 °C ... + 30 °C + 5 °C ... + 40 °C Sweep accuracy over any two divisions of 10 DIV sweep is ± 5 %. Exclude the first and last DIV at the 5 ns and 10 ns magnified sweep rates.
<i>Magnifier</i>		
<i>Magnification</i>	10x	Switched, calibrated
<i>Additional error</i>	± 1 %	First and last Div. of 5 ns, 10 ns and 20 ns magnified sweep rates excluded.
<i>Max. effective time coefficient</i>	5 ns/Div.	
<i>Variable hold-off time</i>	The sweep hold-off time is continuously adjustable to at least a factor of 10	
MAIN TIME BASE TRIGGERING		
<i>Modes</i>	Auto	Automatic free-run of the time-base generator approx. 100 ms after disappearance of the trigger signal.
	Trig	
	Single sweep	
<i>Sources</i>	Internal from ch. A Internal from ch. B External Internal from line	Via EXT input Via build-in opto-isolator
<i>Signal selection</i>	TTL DC AC Above stated bandwidth applies to both internal and external signals	Automatic TTL triggering 0-120 MHz 20 kHz (–3 dB) - 120 MHz
<i>TTL logic levels</i>	Low High Trigger gap Temp. range	+ 0,8 V ($\pm 0,4$ V) + 2 V ($\pm 0,4$ V) 1,2 V 15° ... 30 °C
These data apply to voltages on the tip of a 1:10 attenuator probe connected to the EXT input socket.		
When the trigger signal is taken internally from ch. A or ch. B the corresponding input-attenuator must be set in such a way that the TTL-signal display height is 2 divisions.		
TTL triggering cannot be used with LINE as trigger source.		

Designation	Specification	Additional information
<i>Slope</i>	+ or –	
<i>Sensitivity</i>	Internal $\leq 0,5$ DIV External ≤ 200 mV	Typical sensitivity as a function of the frequency, refer to Fig. 1.3.
<i>Level range</i>	24 DIV – 3,6 V to + 3,6 V Above Sensitivity and Level range data apply to AC or DC triggering	Internal External
<i>Ext. Input</i>	1 MOhm//15 pF	Identical to Y input
<i>Max. permissible input voltage</i>	± 400 V	d.c. + a.c. peak.
DELAYED TIME BASE		
<i>Operation</i>		
<i>Normal delay operation</i>	Direct after delay-time Triggerable after delay time	Started by main time-base Triggerable by the signal from ch. A, ch. B, or external
<i>Digital delay</i>	By pulse counting	Pulses from ch. A, or ch. B, or external
<i>Time coefficients</i>	0,5 s/DIV ... 50 ns/DIV	Twenty-two calibrated positions in 1-2-5 sequence. Uncalibrated continuous control 1: $\geq 2,5$ between the steps.
<i>Coefficient error</i>	± 2 % ± 3 %	+ 20 °C ... + 30 °C + 5 °C ... + 40 °C Sweep accuracy over any two divisions of 10 DIV sweep is ± 5 %. Exclude the first and last DIV at the 5 ns and 10 ns magnified sweep rates.
<i>Delay time</i>	Continuously variable between 0x and 10x the time coefficient of the main time base	Range delay-time multiplier 0,00 - 9,99. Incremental accuracy 0,5 %; typical 0,2 %.
<i>Delay-time jitter</i>	1:20 000	Typical value 1:30 000
<i>Delayed gate output</i>	Rear panel BNC connector providing logic "1" TTL output pulse during main time base intensified and delayed time base running times. Output impedance 3 kOhm	Short-circuit proof.

DELAYED TIME BASE TRIGGERING

<i>Sources</i>	Internal from ch. A Internal from ch. B External MTB	Triggerable after delay interval. Triggered by main sweep immediately after delay
<i>Signal selection</i>	DC LF-internal LF-external HF	0-120 MHz 0-20 kHz (–3 dB) 10 Hz-20 kHz; –3 dB 20 kHz-120 MHz; –3 dB
<i>Slope</i>	+ or –	
<i>Sensitivity</i>	Internal $\leq 0,5$ DIV External ≤ 200 mV	Typical sensitivity, as a function of the frequency, see Fig.1.3
<i>Level range</i>	24 DIV – 3,6 V to + 3,6 V	Internal External
<i>Ext. Input impedance</i>	1 MOhm//15 pF	Identical to Y input
<i>Max. permissible input voltage</i>	± 400 V	d.c. + a.c. peak.

Designation	Specification	Additional information
<i>Digital delay operation</i>	The digital delay is operative if the DIG DELAY pushbutton is depressed	The position MAIN TB of the <u>DELAYED TB TRIG source</u> <u>overrides the DIG DELAY function.</u> So the trigger source A, B or EXT should be selected.
<i>Event number setting</i>	The event number can be set to any value between 0000 and 9999. This number is preset to 0001 when dig delay is selected and when the instrument is switched on.	The circuit is layed out to accomodate for event numbers between 00000 and 99999. The presetting to 0001 applies only when the count potmeter is in the stop position.
<i>Event number control</i>	The event number can be increased by setting the count potmeter in the up position In the down position the event number will decrease	There is a mechanical lock for the stop position. From 9999 the event will go to 0000, From 0000 the event number will go to 9999.
<i>Up/down count potmeter</i>	The event number will be changed with a count rate proportional to the rotation of count potmeter out of the stop position.	
<i>Up/down count rate</i>	Slow: $\leq 1 \text{ Hz}$ to $\geq 60 \text{ Hz}$ Fast: $\leq 20 \text{ Hz}$ to $\geq 1 \text{ kHz}$	Typ 0,7 Hz to 100 Hz Count potmeter control depressed . When the potmeter is set out of the stop position the event number will increase or decrease by 1 immediately. Typ 10 Hz to 1,5 kHz Count potmeter control pulled.
<i>Events</i>	Events are trigger points selected by the delayed time base trigger control	
<i>Event counter</i>	The event counter counts events starting with the first event after the set up time T_s. When the event counter has counted the selected number of "Event -1" the counter delivers a ready pulse to the delayed time base which will start on the first trigger pulse after T_{dr} Refer to Fig.1.4	T_s is the time by which the trigger point of the delayed time base must be delayed in respect to the trigger point starting the main time base in order to be recognized by the event counter as event number 1. T_s is typ 15 ns. T_{dr} is the time between the trigger point which is the selected event number -1 and the time that the delayed time base is ready to start on the next trigger pulse. T_{dr} is typ 45 ns. When the event number is set to 0000 or 0001 the ready pulse is present already during the start of the Main time base. The Delayed time base requires then a typ 25 ns to be enable by the start of the main time base.

Designation	Specification	Additional information
<i>Max Event rate</i>	Max event rate ≥ 50 MHz	This is the rate of events which can be recognized by the event counter
<i>Event pulse width</i>	≥ 10 ns	This is the minimum pulse width of the trigger signal of the delayed time base following the selected trigger slope in order to be recognized by the event counter.
<i>Delayed time base NOT TRIG'D lamp</i>	Warns for loss of trigger and or wrong setting of time base combination.	Can be used as selective logic probe under single shot conditions
CALIBRATOR		
<i>Voltage</i>	3 V _{p-p}	Positive square wave, base-line zero volts
<i>Current</i>	6 mA	Through current loop
<i>Accuracy</i>	$\pm 1 \%$	For both voltage and current
<i>Frequency</i>	2 kHz $\pm 2 \%$	
<i>Protection</i>	The output is short-circuit-proof	
POWER SUPPLY		
<i>Line voltages</i>	AC: 100 ... 240 V, $\pm 10 \%$ DC: 130 ... 350 V, $\pm 10 \%$	90 VAC at specified line voltage distortion of peak/rms ratio: $\sqrt{2} \pm 2 \%$ and $B \leq 0,005$ (IEC 359)
<i>Line frequency</i>	46 to 440 Hz	or DC
<i>Build-in line fuse</i>	2 amps, slow-blow	For all line voltages
<i>Power consumption</i>	45 W	
ENVIRONMENTAL CAPABILITIES		
The environmental data are valid only if the instrument is checked in accordance with the official checking procedure. Details on these procedures and failure criteria are supplied on request by the PHILIPS organisation in your country, or by N.V. PHILIPS' GLOEILAMPENFABRIEKEN, TEST AND MEASURING DEPARTMENT, EINDHOVEN, HOLLAND.		
<i>Ambient temperature</i>	+ 5 °C ... + 40 °C – 10 °C ... + 55 °C – 40 °C ... + 70 °C	Rated range of use Limit range of operation Storage and transport conditions
<i>Altitude</i>	5 000 m 15 000 m	Operating Not operating
<i>Humidity</i>	The instrument meets the requirements of the IEC 68 dB recommendations.	
<i>Bump</i>	1000 bumps of 10 g, ½ sine, 6 ms duration, in each of 3 directions.	
<i>Vibration</i>	30 minutes in each of three directions, 10-150 Hz; 0,7 mm p-p and 5 g max. acceleration	

Designation	Specification	Additional information
<i>Recovery time</i>	15 minutes	Coming from — 10 °C and going to + 20 °C at 60 % relative humidity
	WARNING: When an instrument is brought from the cold into a warm environment, condensation may cause a hazardous condition. Therefore, make sure that the earthing requirements are strictly adhered to.	

MECHANICAL DATA

<i>Dimensions</i>	Length	410 mm (16 1/4")	Excl. controls, cover and feet
	Width	316 mm (12 1/4")	
	Height	154 mm (6 1/8")	
<i>Weight</i>	9,3 kf (20,5 lbs)		

ACCESSORIES

Accessories delivered with the instrument

One contrast filter
 Front cover with storage space
 Collapsible viewing hood PM 9366
 Banana - BNC adapter PM 9051
 CAL terminal - BNC adapter
 Manual

Optional accessories

<i>Probes</i>		
PM 9335	1:1 voltage probe, 1,5 m cable	
PM 9335L	1:1 voltage probe, 2,5 m cable	
PM 9347	Active T.V. probe	
PM 9351	1:10 voltage probe, 1,5 m cable	
PM 9351L	1:10 voltage probe, 2,5 m cable	
PM 9352	Active 10:1 micro-miniature probe (100 kohm//6 pF)	
PM 9353	Active FET probe	
PM 9355	Current probe (50 MHz)	
PM 9358	1:100 H.V. probe 5,6 kV max. (20 MOhm//2 pF)	

Miscellaneous

PM 8901	Battery pack
PM 8910	Polaroid anti-glaze contrast filter
PM 8960	Rack-mounting adaptor
PM 8971	Camera adaptor for PM 9380
PM 8980	Long viewing head
PM 8991	Trolley
PM 8992	Accessory pouch
PM 9346	Probe power supply (+ 24 V, — 24 V, 2x50 mA)
PM 9380	Oscilloscope camera
M3...M5	Oscilloscope camera Steinheil Oscillosphot

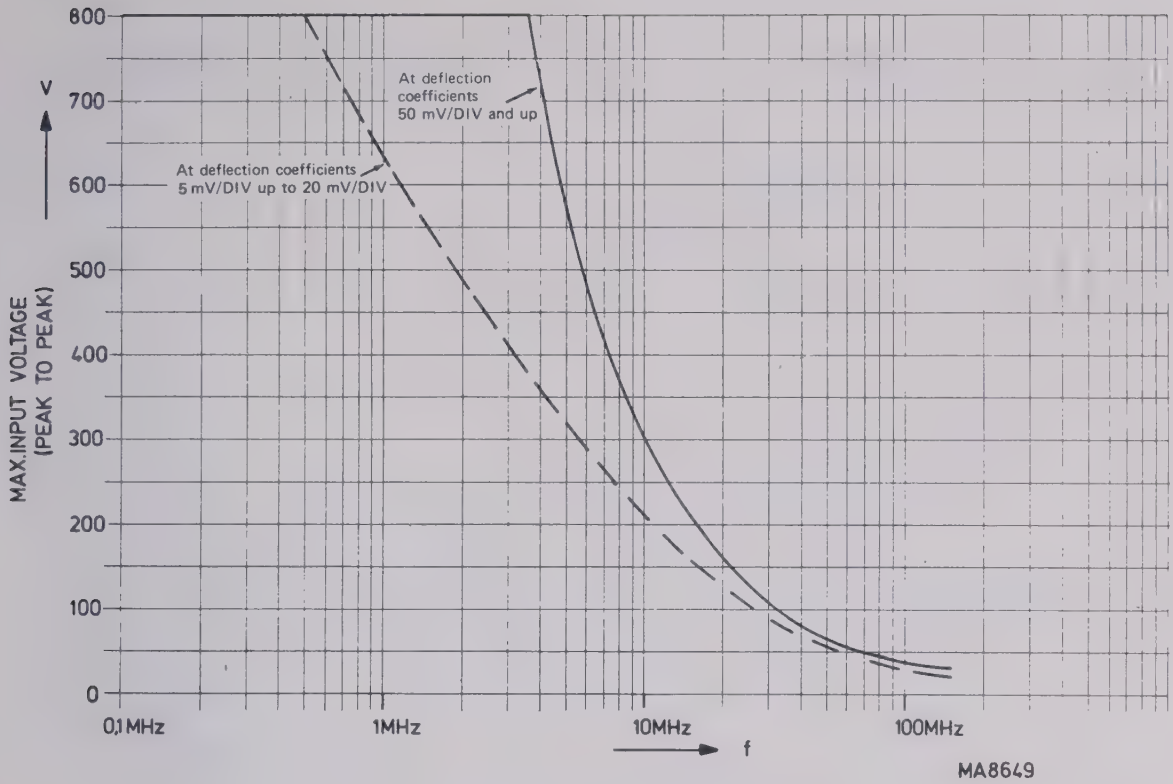


Fig. 1.2. Derating of the maximum permissible input voltage as a function of frequency

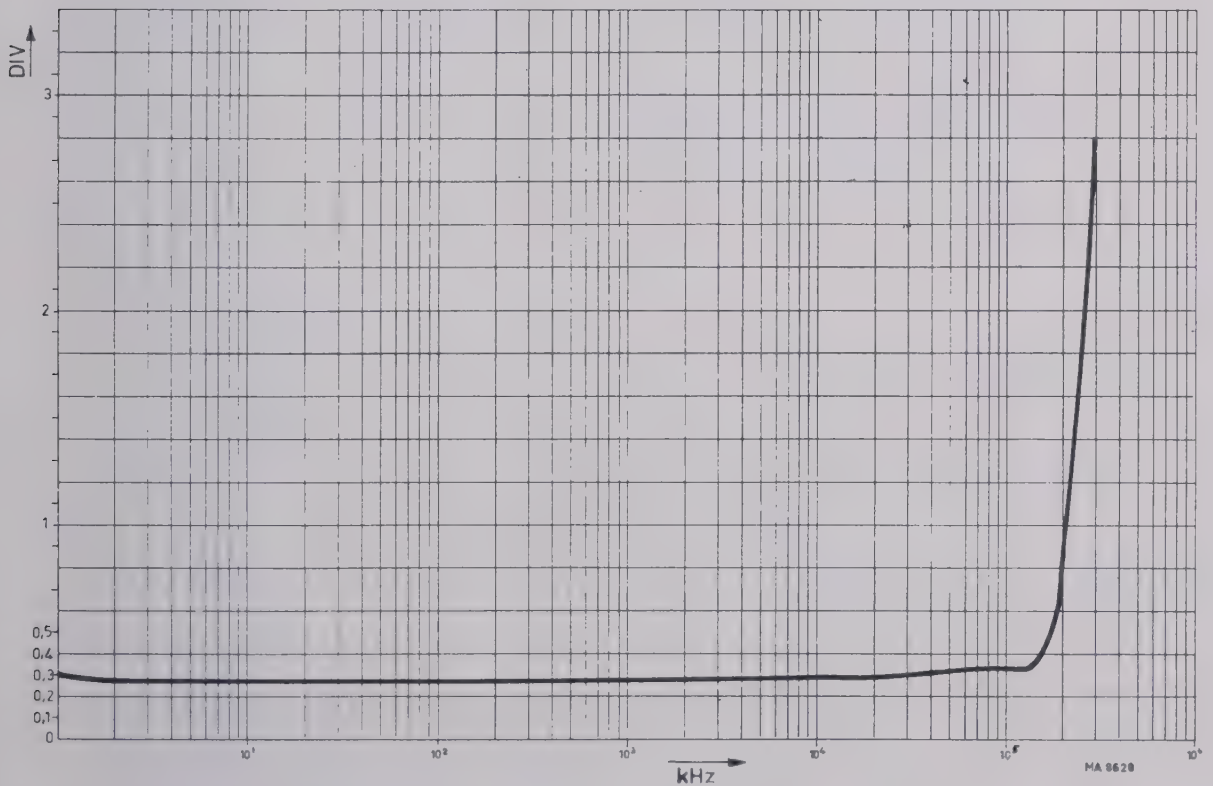


Fig. 1.3. Typical trigger sensitivity of channel A as a function of frequency

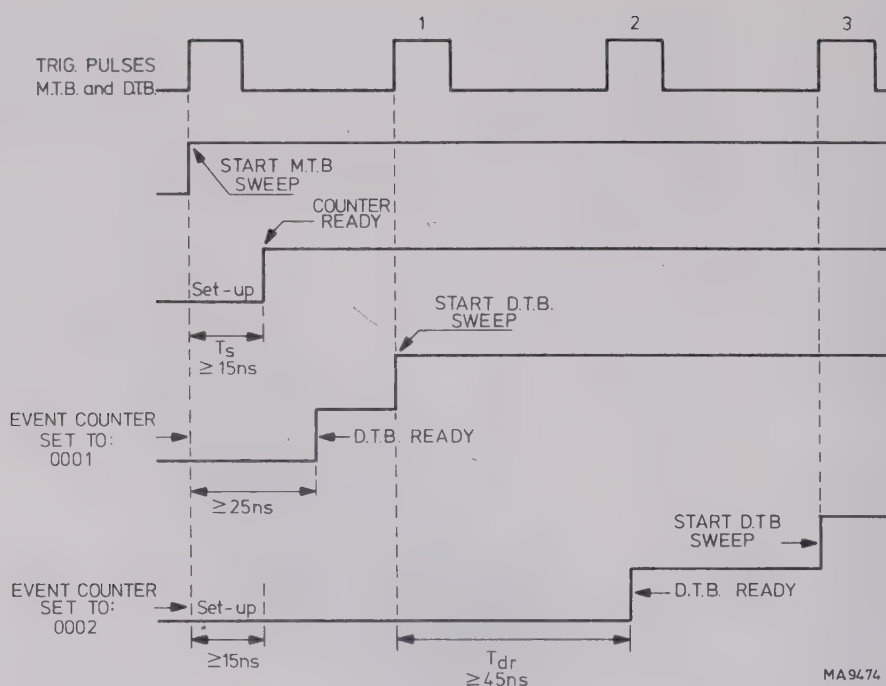


Fig. 1.4. Most critical situation of Digital Delay triggering.

Example for pulse repetition time of 40 ns (freq. 25 MHz).

Same trigger pulse for main- and delayed time-base.

Limit Conditions:

1. True counting starts after "set-up" time of $\geq 15\text{ ns}$ after triggering of Main Time-base.
2. EVENT counter set to "0001": The Delayed time-base is ready $\geq 25\text{ ns}$ after Main time-base triggering.
3. EVENT counter set to "n": The Delayed Time-base is ready $\geq 45\text{ ns}$ after pulse "n - 1".
4. Counting is correct till frequencies upto $\leq 22\text{ MHz}$.

2. Directions for use

2.1. INSTALLATION

Front cover

Removing:

- Turn the knob in the centre of the cover a quarter of a turn counter-clockwise.
- Take the cover off.

Fitting:

- Align the key of the locking knob with the slot in the text plate of the instrument.
- Fit the cover over the front of the oscilloscope.
- Press the knob and turn it a quarter of a turn clockwise.

The room in the front cover is available to accommodate accessories such as probes, collapsible viewing hood.

To open the front cover press both tongues of the locking device and lift the inner plate.

The handle can be rotated if the push-buttons on its bearings are depressed.

Mains adjustment and fuse

The ability of the instrument to operate at any line voltage between 90 and 270 V a.c. or between 100 and 200 V d.c. obviates the need of adaption to the local line voltage.

The fuse holder is mounted on the rear panel. The 2 A delayed action fuse is used at all line voltages.

Make sure that only fuses with the required rated current and of the specified type are used for replacement.

The use of mended fuses and the short-circuiting of fuse holders shall be avoided. The instrument shall be disconnected from all voltage sources when a fuse is to be replaced.

WARNING : This instrument generates high voltages and should not be operated with the cabinet plates removed.

The line plug must be removed before attempting any maintenance work.

Before any other connection is made, the protective earth terminal shall be connected to a protective conductor (see section *Earthing*).

Earthing

Before switching on, the instrument shall be connected to a protective earth conductor in one of the following ways:

- Via the protective earth terminal (identified by the symbol $\perp$).
- Via the three-core line cable. The line plug shall only be inserted into a socket outlet provided with a protective earth contact. The protective action shall not be negated by the use of an extension cord without protective conductor.

WARNING : Any interruption of the protective conductor outside or inside the instrument or disconnection of the protective earth terminal, is likely to make the instrument dangerous. Intentional interruption is prohibited.

When an instrument is brought from a cold into a warm environment, condensation may cause a hazardous condition. Therefore, make sure that the earthing requirements are strictly adhered to.

Dismantling

The opening of covers or removal of parts, except those to which access can be gained by hand, is likely to expose live parts and also accessible terminals may be live.

The instrument shall be disconnected from all voltage sources before any adjustment, replacement or maintenance and repair during which the instrument will be opened.

If afterwards any adjustment, maintenance or repair of the opened instrument under voltage is inevitable, it shall be carried out only by a skilled person who is aware of the danger involved.

Replacing the mains plug is at the user's own risk. After replacing a mains plug, a high-voltage test in accordance with IEC Publication 348 is strongly recommended.

Bear in mind that capacitors inside the instrument may still be charged, even if the instrument has been separated from all voltage sources.

Switching on

The POWER switch is incorporated in the graticule ILLUMINATION control on the front panel, immediately below the screen bezel.



Fig. 2.1. Removing the front cover

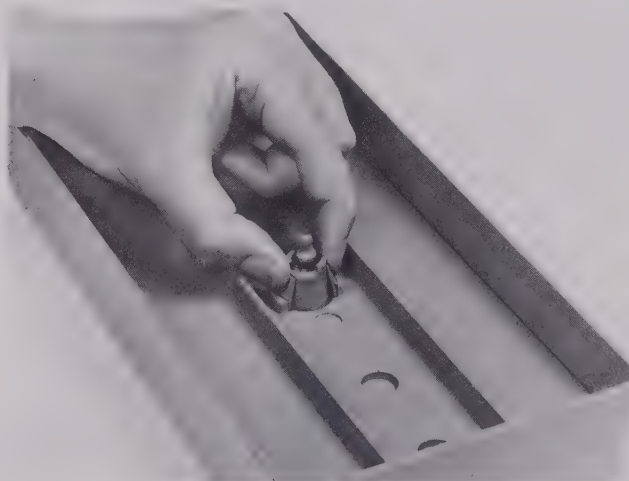


Fig. 2.2. Opening the front cover

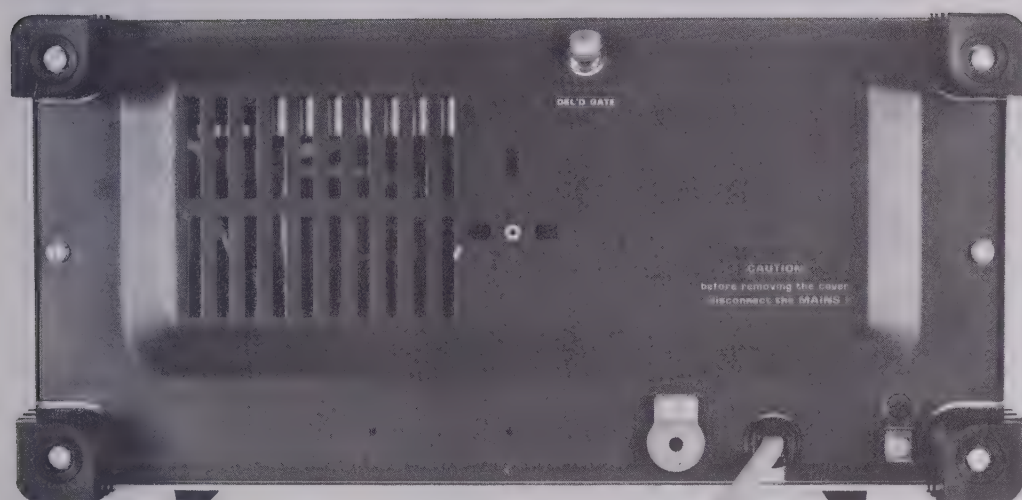


Fig. 2.3. Rear view

2.2. FUNCTION OF CONTROLS AND CONNECTORS

Vertical Deflection

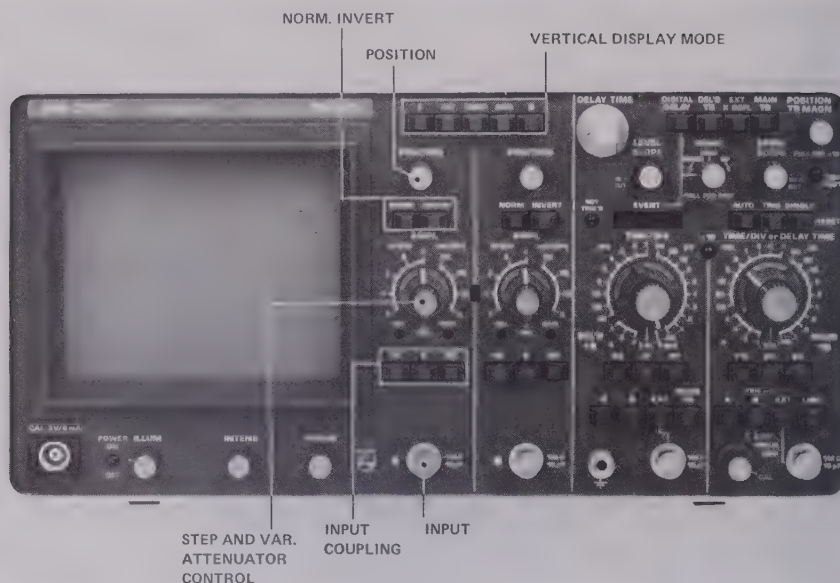


Fig. 2.4. Vertical Deflection

VERTICAL DISPLAY MODE

- A - channel A only.
- ALT - channels A and B alternately displayed.
- CHOP - channels A and B chopped displayed.
- ADD - channels A and B algebraically added.
- B - channel B only.

If no button depressed, channel A is on.

POSITION

Continuously variable control giving vertical shift of the relevant channel.

NORM-INVERT

This switch facilitates inverting of the input signal polarity.

STEP AND VARIABLE ATTENUATOR CONTROL

- AMPL/DIV Step control of the deflection coefficients, combined with :
- CAL Continuous variable control of the deflection coefficients.
In the CAL position the deflection coefficient is calibrated.

INPUT COUPLING

- AC — Signal coupling via a blocking capacitor.
- O — Input connected to earth; signal-load open.
- DC — Direct coupling.

(if no button is depressed, the AC condition is on).

PRESET CONTROLS

- BAL Step attenuator balance compensation
- GAIN Step attenuator amplitude calibration.

Horizontal Deflection

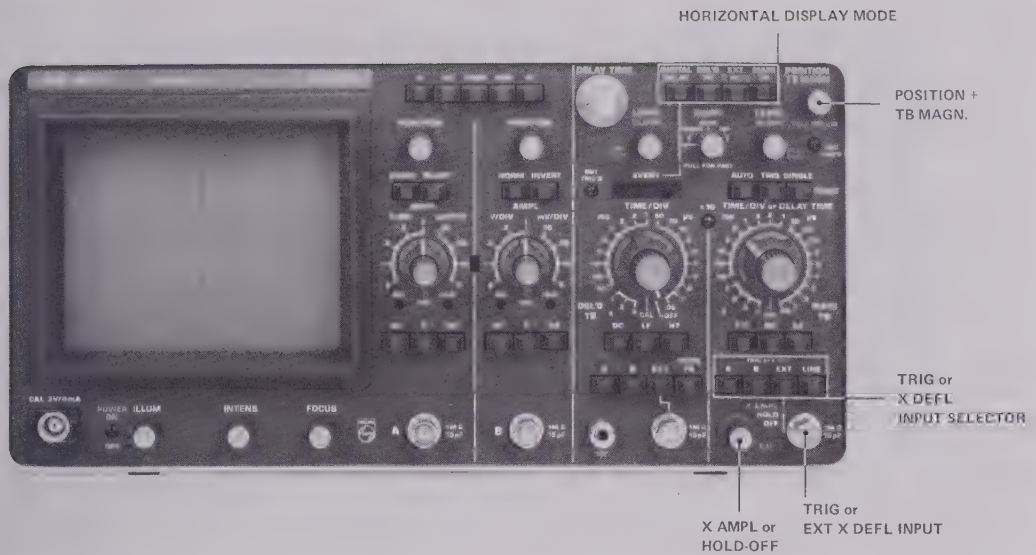


Fig. 2.5. Horizontal Deflection

HORIZONTAL DISPLAY MODE

MAIN TB

The horizontal deflection is provided by the main time base generator. A part of the display is intensified when the delayed time base is on.

EXT X DEFL

Horizontal deflection is achieved by an external signal coming from:

- Input socket of the horizontal amplifier, or
- One of the vertical deflection channels or
- The line.

DEL'D TB

The horizontal deflection is provided by the delayed time base generator.

DIGITAL DELAY

Digital delay operative

(if no button is depressed, the main tb is on).

POSITION + TB MAGNIFIER

POSITION

Continuously variable control giving horizontal shift of the display

TB MAGN

Push-pull switch which increases the time-base coefficients by a factor of 10.

Not operative in the EXT X DEFL. mode.

TRIG or X DEFL. INPUT SELECTOR

MTB trigger source selector, or horizontal deflection source selector in the EXT X DEFL. mode.

A - source : ch. A

B - source : ch. B

EXT - source : EXT via EXT input socket

LINE - source : line voltage (mains)

TRIG or EXT X DEFL. INPUT

Input socket to apply the external trigger or horizontal deflection voltage.

X AMPL or HOLD OFF

This knob permits control of the horizontal deflection amplitude in case of EXT X DEFL. If the MAIN TB has been selected for horizontal deflection this knob permits control of the hold-off time.

Main Time Base

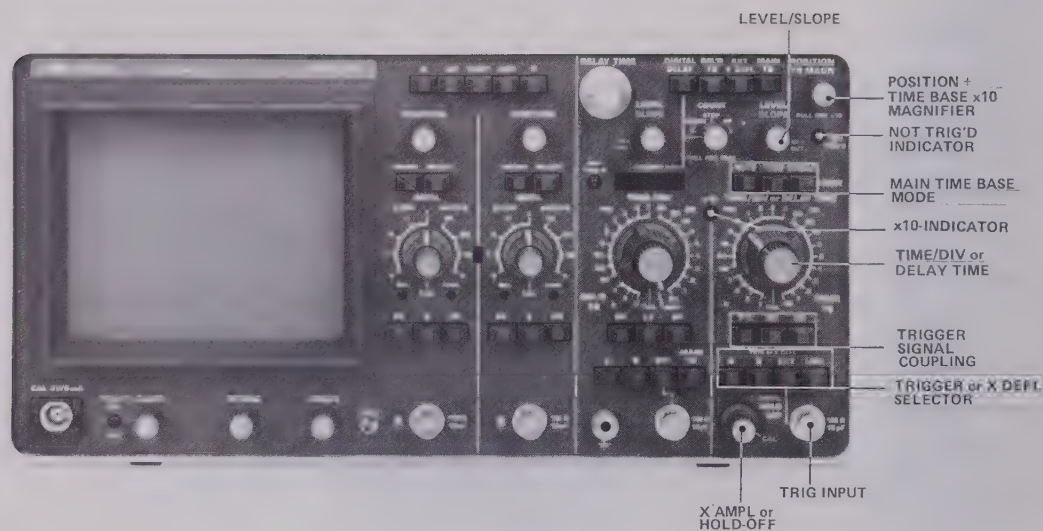


Fig. 2.6. Main time base

MAIN TIME-BASE MODE

- AUTO The main time-base is free-running when no trigger pulses are present.
- TRIG The main time-base is normally triggered.
- SINGLE Single sweep time-base. After operating the SINGLE button, the main time-base generator runs only once upon receipt of a trigger pulse. (if no button is depressed the time-base is in the single sweep mode).

TIME/DIV or DELAY TIME

Step and continuous control of the main time-base sweep coefficients; 23-way rotary switch.

If the normal delayed time-base mode is used, the delay time after which the delayed time-base starts, is the product of the DELAY TIME calibrated dial setting and the TIME/DIV setting of this switch.

Only in the CAL position of the continuous control the sweep coefficients are calibrated.

LEVEL/SLOPE

Continuously variable control to select the trigger level at which the time-base generator starts.

The push-pull switch enables choice of triggering on the positive- or negative-trigger going slope of the signal.

TRIGGER SIGNAL COUPLING

- TTL Main time-base triggers on TTL logic level
 The LEVEL control is not operative.
- DC Main time-base trigger is sensitive over the whole bandwidth (d.c. . . . 120 MHz).
- AC Main time-base trigger is sensitive only for a.c. signals (20 kHz ... 120 MHz).

TRIGGER or X DEFL. SELECTOR

If the instrument is used in the time-base mode, the main time-base can be triggered by :

A	Signal taken internally from channel A
B	Signal taken internally from channel B
EXT	Signal applied to the trigger input socket
LINE	Line voltage (mains) internally connected.

TRIG INPUT

Input socket for applying an external trigger signal.

POSITION, TIME BASE MAGNIFIER

Continuous horizontal shift control. If the knob is pulled the time-base sweep speed is multiplied by 10 (indicated by the X10 pilot lamp.)

NOT TRIG'D INDICATOR

Lights up when the time-base generator is not triggered.

X AMPL or HOLD OFF

Controls the hold-off time of the main time-base generator.

In the EXT X DEFL. mode the horizontal deflection amplitude can be varied.

Delayed Time Base

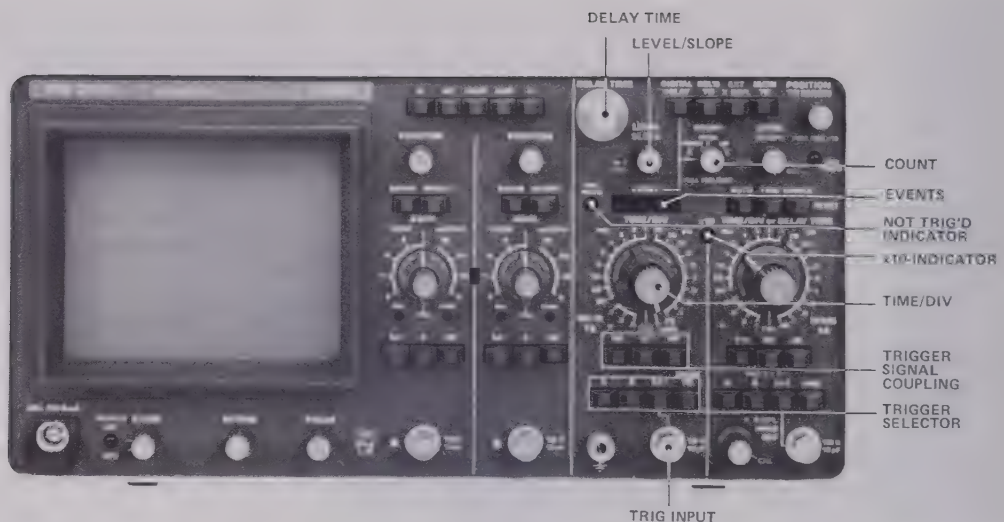


Fig. 2.7. Delayed time base

TIME/DIV

Step and continuous control of the delayed time-base sweep coefficients; 22-way rotary switch with additional OFF position.

Only in the CAL position of the continuous control the sweep coefficients are calibrated.

DELAY TIME

If the normal delayed time-base is used the delayed time-base starting point, is the product of the DELAY TIME multiplier setting and the selected TIME/DIV value, at the main time-base TIME/DIV control.

LEVEL/SLOPE

Continuously variable control to select the trigger level at which the delayed time-base generator starts. The push-pull switch enables choice of triggering on the positive- or negative-trigger going slope of the signal.

TRIGGER SIGNAL COUPLING

Selection of the frequency-depending sensitivity of the delayed time-base trigger circuit.

DC	Full bandwidth (d.c. ... 120 MHz).
LF	Low frequency (10 Hz ... 20 kHz). Any influence of h.f. noise signals is then suppressed.
HF	High frequency (20 kHz ... 120 MHz). To suppress any influence from l.f. signals e.g. hum.

TRIGGER SELECTOR

Selects the trigger source for the delayed time-base.

A	- Signal taken internally from channel A
B	- Signal taken internally from channel B
EXT	- Signal which is applied to the trigger input socket.
MAIN TB	- The delayed time-base starts immediately after the delay time (in the normal delayed time-base mode). <u>This switch overrides the DIGITAL DELAY switch.</u>

TRIG INPUT

Input socket for applying an external trigger signal.

POSITION, TIME BASE MAGNIFIER

Continuous horizontal shift control. If the knob is pulled the time-base sweep speed is multiplied by 10 (indicated by the X10 pilot lamp).

NOT TRIG'D INDICATOR

Lights up when the delayed time-base generator is not triggered.

Indicates that the number of pulses to be counted exceeds the number of pulses that is shown on the c.r.t. (wrong setting of time-base combination).

COUNT

This knob controls the EVENT display contents, thus determining the number of pulses to be counted.

Turning the knob from the centre-stop to the right increases the number of pulses to be counted.

Turning the knob from the centre-stop to the left decreases the number of pulses to be counted.

The c-character in the display indicates that the contents is changing.

In the centre-stop position of the knob the display contents remain constant.

EVENT

Four bit, 7 segment led display showing the number of pulses to be counted to trigger the delayed time-base. The display is blanked if the digital delay is not operative.

C.r.t. display section

POWER/ILLUM

Continuously variable control for the graticule illumination combined with power on-off switch.

Pilot lamp indicates the ON state.

INTENS

Continuously variable control of the display-brightness.

FOCUS

Continuously variable control of the electron-beam focussing.

CAL

Output socket for calibration of:

- The gain of the vertical deflection amplifier and,
 - The frequency compensation of attenuator probes.
- Suited for voltage probes and current probes.

Rear Side (refer to Fig. 2.3).

DEL'D GATE

TTL compatible delayed time-base gate output.

“High” during main time-base intensified, and delayed time-base running times.

2 AT

2 Amps slow-blow line fuse; for all line voltages

Mains cord and protective earth terminal ().

2.3. PRELIMINARY SETTINGS

Before measurements with this oscilloscope are carried out, check that the step-attenuator balance and the gain calibration for each channel are well adjusted.

If necessary proceed as follows:

1. Adjusting the step attenuator d.c. balance.

- Depress the MAIN TB button of the horizontal deflection mode switch.
- Depress the AUTO button of the main time-base mode switch.
- Set the INTENSITY and FOCUS controls for a sharp, well-defined trace.
- Depress the relevant channel button of the vertical deflection mode switch.
- Depress the 0 button of the input coupling switch.
- Set the POSITION knob so that the trace is somewhere about in the centre of the screen.
- Set the AMPL. continuous control at position CAL.
- Check that the trace does not jump when the AMPL. switch knob is rotated
- If necessary adjust the BAL control.

2. Gain calibration.

Unless otherwise stated, the controls occupy the same positions as in the previous procedure.

- Set the AC-0-DC switch to AC.
- Set the AMPL. switch knob to .5 V and continuous control to CAL.
- Connect the channel input to the CAL output.
- Check that the vertical deflection is exactly 6 divisions.
- If necessary adjust the GAIN control.
- As an attenuator probe can be included in this calibration. The probe attenuation factor must then be taken into account with respect to the AMPL. switch position.

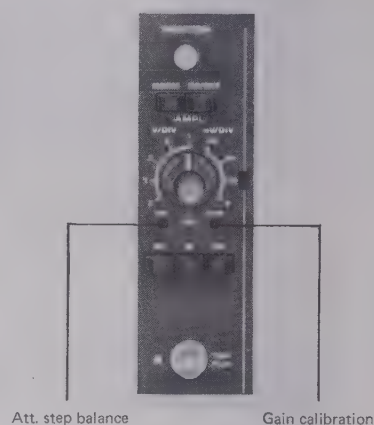


Fig. 2.8.

2.4. OPERATING INSTRUCTIONS

General

Before switching-on, ensure that the oscilloscope has been correctly installed in accordance with the INSTALLATION recommendations (Chapter 2.1.) and that the precautions outlined have been observed.

Vertical deflection

To display the desired channel, depress the corresponding button of the vertical mode switch. If two traces need to be displayed, the display can be either in the alternate- or in the chopped mode.

In the alternate mode, the channels are displayed successively; during flyback of the time-base sweep the display is switched-over from one channel to the other. In the chopped mode, the channels are successively switched from one to the other during the time-base sweep. The display time in the chopped mode is approx. 500 ns per channel.

To obtain a steady display the alternate mode is generally used at the higher sweep speeds and the chopped mode at the lower speed speeds.

The signals under observation are fed to input sockets A and B and the AC/0/DC switch is set to either AC or DC, depending on the composition of the signal. As the vertical amplifiers are d.c. coupled, the full bandwidth of the instrument is available and d.c. components are displayed as trace shift in the DC position of the AC/0/DC switch.

This may be inconvenient when small signals superimposed on high d.c. voltages must be displayed. Any attenuation of the signal will also result in attenuation of the small a.c. component. The remedy is to use the

AC position of the input switch, which employs a blocking capacitor, to suppress the d.c. component. Some pulse droop, however, will occur when l.f. squarewave signals are displayed.

The 0 position interrupts the signal path and earths the amplifier input for quickly determining the 0 V level. The position controls permit the display to be shifted in the vertical direction.

Horizontal deflection

Depending on the horizontal display switch, the horizontal deflection source can be:

- Main time-base
- Ext. X defl.
- Delayed time-base

The fourth switch - Digital Delay - makes the event counter of the delayed time-base operative.

With the position control, combined with the time-base magnifier, the display can be shifted in the horizontal direction.

If the MAIN TB or DEL'D TB button is depressed the horizontal deflection is effected by the main time-base or the delayed time-base respectively.

If the EXT X DEFL button is depressed the horizontal deflection can be taken from:

- One of the vertical deflection channels A, B, C or D
- Line voltage (mains)
- Externally via EXT connector

The time-base magnifier is not operative in the EXT X DEFL mode.

Main time-base

Linear horizontal deflection is obtained when the MAIN TB button of the horizontal display switched is depressed.

The time-base mode can be chosen by the time-base mode switch :

AUTO	— Time-base is running, even if no trigger pulses are present. The trace is, therefore, always visible. - The AUTO mode can be used in all cases where the TRIG mode is also valid, except with signal frequencies lower than 10 Hz, or pulse trains with an off-time exceeding 100 ms. - As soon as trigger pulses are present, the free-running state of time-base is automatically terminated and the time-base generator is normally triggered.
TRIG	— The time-base is visible when trigger pulses are present, and trigger-level control is correct.
SINGLE	— The time-base makes only one sweep after receipt of a trigger pulse. After this sweep the time-base must be reset by again depressing the SINGLE button. - When effects that occur only once have to be observed (usually photographed), it is often desirable to ensure that only one sweep is generated even though several trigger pulses might be produced after the phenomenon of interest.

The sweep times of the main time-base are set with the TIME/DIV or DELAY TIME knob. With the centre knob, time-base sweep times between the steps can be adjusted. For time measurements this knob must always be in the CAL position. The TIME/DIV coefficient of the time-base can be increased by a factor of 10, by pulling the TB MAGN push-pull knob.

The normal position of the HOLD OFF control is fully clockwise. By turning the control anti-clockwise, the hold-off time is extended.

With the HOLD OFF control, the hold-off time of the main time-base generator can be varied. This is the time needed by the time-base generator to be ready for receipt of the next trigger pulse. The HOLD OFF control permits steady display of more complicated signals e.g. periodic double-pulses.

Main time-base triggering

To obtain a stable display, the time-base sweep must always be started on one fixed point of the signal. The time-base generator is, therefore, started by trigger pulses that are derived from the following signals, depending on the main time-base trigger selector switch :

- channel A
- channel B
- external voltage, applied to the corresponding input socket
- line voltage (mains); the coupling with the line voltage is obtained by a built-in opto-isolator circuit, hence the instrument remains isolated from the line voltage.

With the LEVEL control, the point of triggering on the slope of the signal can be chosen. The SLOPE push-pull switch permits selection of the positive- or negative-going slope.

If the main time-base generator receives no trigger pulses, the NOT TRIG'D indicator lights up. In the SINGLE sweep mode this indicator lights up if the time-base generator has been reset and is waiting for the next trigger pulse.

Three means of trigger coupling can be selected by the trigger mode switch :

- TTL The main time base trigger circuit is now adopted for automatic triggering on TTL signals. The level control is not operative.
- DC The main time-base trigger circuit is sensitive over the whole bandwidth from d.c. upwards.
- AC The main time-base trigger circuit is sensitive for a.c. signals only. The d.c. components of the trigger signal is blocked.

Delayed time-base

If the MAIN TB button of the horizontal display switched is depressed, and the delayed time-base TIME/DIV knob is not in the OFF position, part of the main time-base sweep line is displayed at higher intensity.

In this way, part of the displayed signal can be selected for more detailed observation. The selected part of the signal is displayed over the whole screen by pressing the DEL'D TB switch.

The sweep time of the intensified part of the main time-base sweep depends on the delayed time-base TIME/DIV knob.

With the centre knob, sweep time between the steps can be adjusted. For time measurements this knob must always be in the CAL position.

a. Normal Delay

In this mode the DIGITAL DELAY switch is not depressed.

The exact starting time of the delayed time-base is determined by the settings of the main time-base TIME/DIV or DELAY TIME knob and the DELAY TIME 10-turn multiplier knob.

If the MAIN TB trigger selector switch of the delayed time-base is pressed, the delay time after which the delayed time base is started, is the product of the main time-base TIME/DIV switch setting and the DELAY TIME multiplier knob.

If instead of MAIN TB, the delayed time-base is triggered by A, B or EXT, the delayed time-base will start after this delay-time and upon receipt of a trigger pulse.

b. Digital Delay

This mode is operative if the DIGITAL DELAY knob is depressed. The DELAY TIME multiplier is now inoperative. The delayed time-base is started after counting a pre-set number of events, which are applied to the delayed time-base trigger circuit. This number of events is shown on the EVENTS display.

The number of events to be counted can be controlled by the COUNT knob.

The trigger pulses (events) can be taken internally from channel A or channel B, or externally via the EXT input.

For both Normal- and Digital Delay, trigger pulse-level and slope control is possible. With the LEVEL control the point of triggering on the slope of the signal can be chosen. The SLOPE push-pull switch permits selection of the positive- or negative-going slope.

Note, when operating at high counting frequencies, it may be necessary to take the following measures to prevent any instability in counting.

- Select different polarity settings of the Main time-base and Delayed time-base SLOPE switches.
- Adjust carefully both Main time-base and Delayed time-base LEVEL controls.

2.5. FULL FIVE DIGITS DISPLAY MODIFICATION

The standard PM 3261 EVENT display consists of four digits with a "c" for count at the fifth most significant bit location.

If desired the EVENT display circuit can be arranged to show five full digits giving a maximum count of 99.999. The "c" indication is then omitted, but instead of, the count action is indicated by the decimal points in the display.

Because of the higher number of counting also the fast display setting oscillator frequency is increased.

Required components:

- 1x SN74LS190B (16 p. DIL I.C.)
- 1x F93S10PC (16 p. DIL I.C.)
- 1x capacitor 0,22 μ F, 63 V, 15 mm pitch

Proceed as follows:

Refer also to Fig's 2.9, 2.10 and 2.11.

- Remove the digital delay unit
- Remove the solder from soldered link A at the upper side of the unit.
- Remove the solder from both soldered links B at the bottom side of the unit.
- Add solder on link C at the bottom of the unit.
- Insert the two digital I.C.'s in addition to the corresponding rows.
- To increase the display setting oscillator frequency replace the 1 μ F capacitor (C2203) by a 0,22 μ F model.
- Remount the unit.

The display unit, located at the front panel, needs no modification.

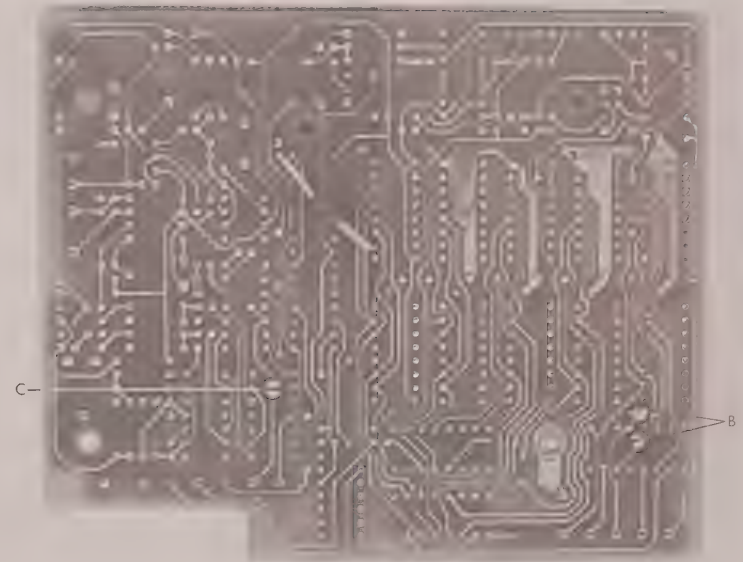


Fig. 2.10. Bottom view digital delay unit

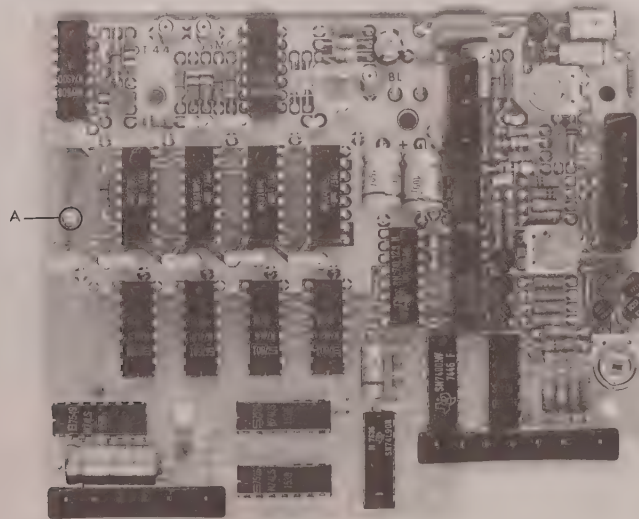


Fig. 2.9. Top view digital delay unit

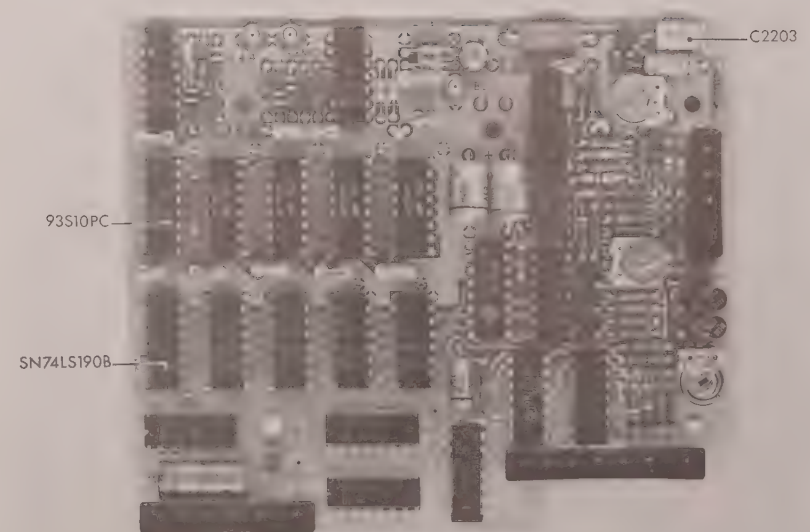


Fig. 2.11. Digital delay unit after five full digit arrangement.

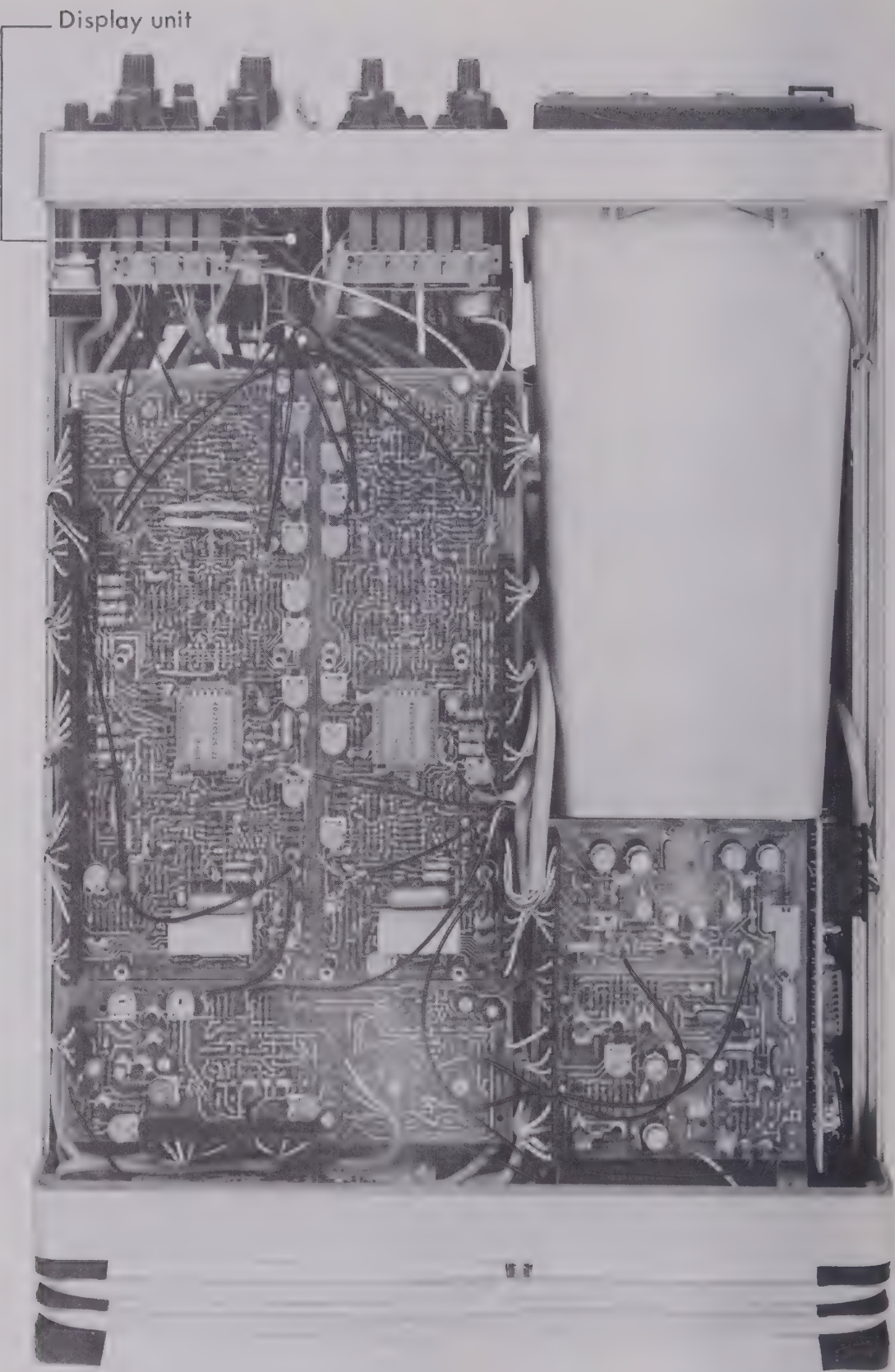


Fig. 3.1. Unit location PM 3261, top view

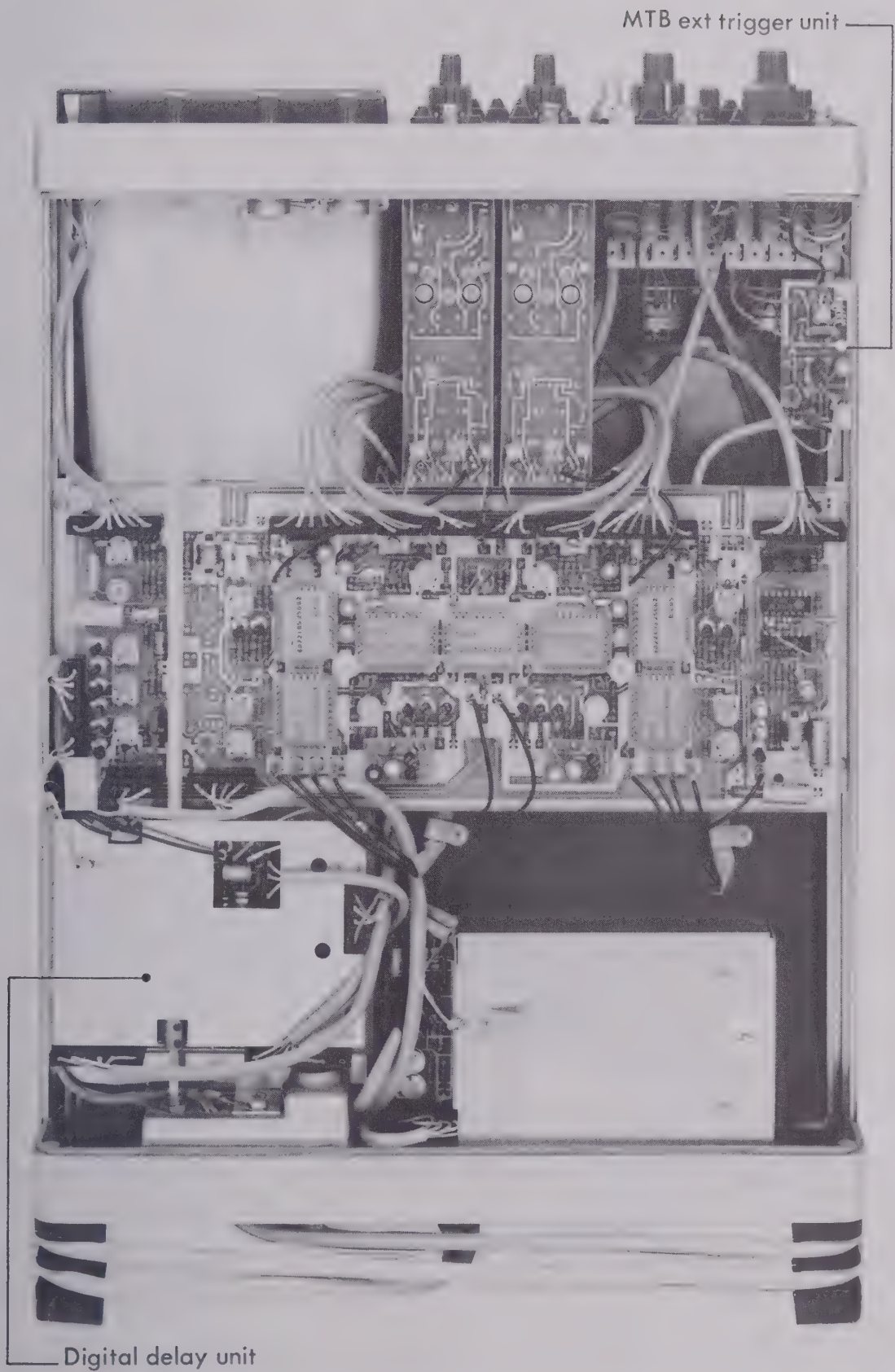


Fig. 3.2. Unit location PM 3261, bottom view

3.1. ADJUSTING THE DIGITAL DELAY SECTION

Adjustment controls R2224 - Gap.

R2214 - Sym.

R2211 - Freq.

⌒ indication.

1. No input signals.
2. MAIN TB and DIGITAL DELAY of horizontal display switch depressed.
3. MAIN TB of delayed time-base trigger source switch **not** depressed.
4. Knob COUNT in centre-lock position.
5. The ⌒ indication must be suppressed also if the COUNT knob is pulled out.
If not, adjust GAP pot. meter R2224.
6. As soon as the COUNT knob is turned out-off the lock position the ⌒ indication must be visible, also if the COUNT knob is pulled-out.
If not, adjust SYM pot. meter R2214.

— Display setting frequency

7. As soon as the COUNT knob (in depressed position) is turned out-off the lock position the display contents must change a number of 10 during 12 up to 18 sec.
If necessary, adjust FREQ. pot. meter R2211.

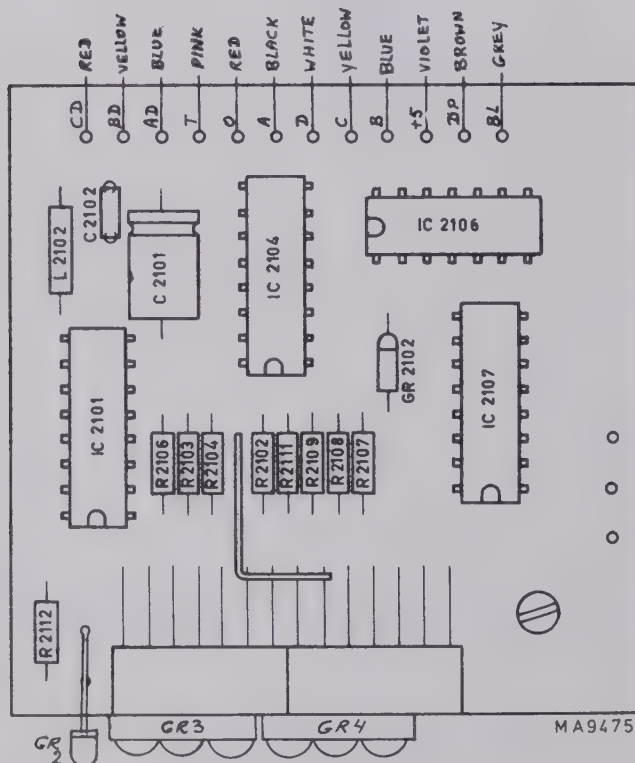


Fig. 3.3. Digital Delay Display Unit

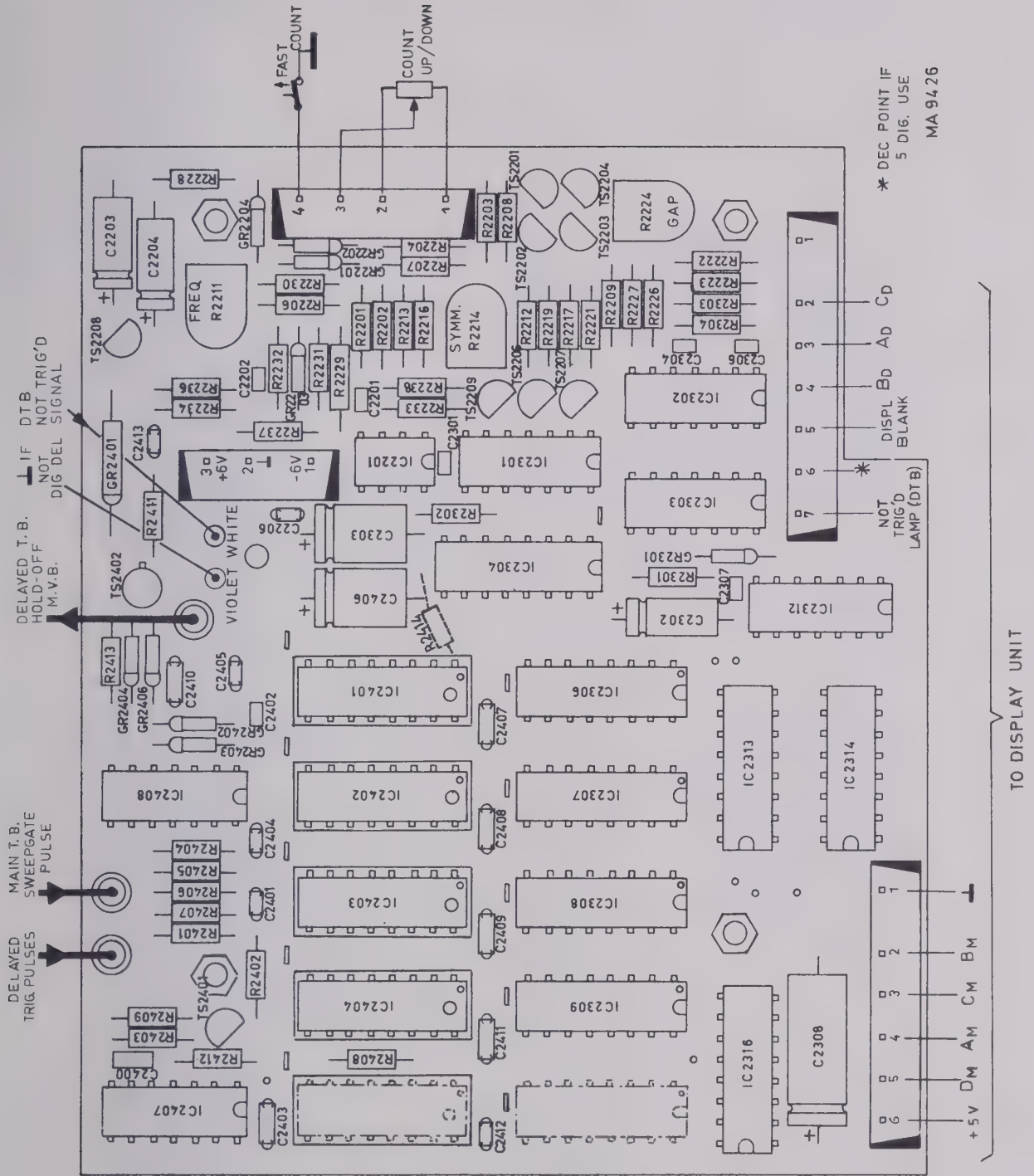


Fig. 3.4. Digital Delay Unit

CODING SYSTEM OF FAILURE REPORTING FOR QUALITY
ASSESSMENT OF T & M INSTRUMENTS
(excl. potentiometric recorders)

The information contents of the coded failure description is necessary for our computerized processing of quality data.

Since the reporting of repair and maintenance routines must be complete and exact, we give you an example of a correctly filled-out PHILIPS SERVICE Job sheet.

① Country	② Day Month Year	③ Typenumber	/Version	④ Factory/Serial no.
3 2	1 5 0 4 7 5	O P M 3 2 6 0 0 2		D O 0 0 7 8 3

CODED FAILURE DESCRIPTION ⑥

⑤ Nature of call	Location	Component/sequence no.	Category	
☐ Installation		T S O 6 0 7	5	⑦ Job completed ☒
☐ Pre sale repair		R 0 0 6 3 1	2	
☐ Preventive maintenance	0 0 2 1	9 9 0 0 0 1	4	
☒ Corrective maintenance				
☐ Other				
				Working time ⑧ 1 2 Hrs

Detailed description of the information to be entered in the various boxes:

①Country: 3 2 = Switzerland

②Day Month Year 1 5 0 4 7 5 = 15 April 1975

③Type number/Version O P M 3 2 6 0 0 2 = Oscilloscope PM 3260, version 02 (in later oscilloscopes this number is placed in front of the serial no)

④Factory/Serial number D O 0 0 7 8 3 = DO 783 These data are mentioned on the type plate of the instrument

⑤ Nature of call: Enter a cross in the relevant box

⑥ Coded failure description

Location

These four boxes are used to isolate the problem area. Write the code of the part in which the fault occurs, e.g. unit no or mechanical item no of this part (refer to 'PARTS LISTS' in the manual).

Example: 0001 for Unit 1
 000A for Unit A
 0075 for item 75

If units are not numbered, do not fill in the four boxes; see Example Job sheet.

Component/sequence no.

These six boxes are intended to pinpoint the faulty component.

A. Enter the component designation as used in the circuit diagram. If the designation is alfa-numeric, the letters must be written (starting from the left) in the two left-hand boxes and the figures must be written (in such a way that the last digit occupies the right-most box) in the four right-hand boxes.

B. Parts not identified in the circuit diagram:

990000 Unknown/Not applicable

990001 Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)

990002 Knob (incl. dial knob, cap, etc.)

990003 Probe (only if attached to instrument)

990004 Leads and associated plugs

990005 Holder (valve, transistor, fuse, board, etc.)

990006 Complete unit (p.w. board, h.t. unit, etc.)

990007 Accessory (only those without type number)

990008 Documentation (manual, supplement, etc.)

990009 Foreign object

990099 Miscellaneous

Category

0 Unknown, not applicable (fault not present, intermittent or disappeared)

1 Software error

2 Readjustment

3 Electrical repair (wiring, solder joint, etc.)

4 Mechanical repair (polishing, filing, remachining, etc.)

5 Replacement (of transistor, resistor, etc.)

6 Cleaning and/or lubrication

7 Operator error

8 Missing items (on pre-sale test)

9 Environmental requirements are not met

⑦ Job completed: Enter a cross when the job has been completed.

⑧ Working time: Enter the total number of working hours spent in connection with the job (excluding travelling, waiting time, etc.), using the last box for tenths of hours.

= 1,2 working hours (1 h 12 min.)

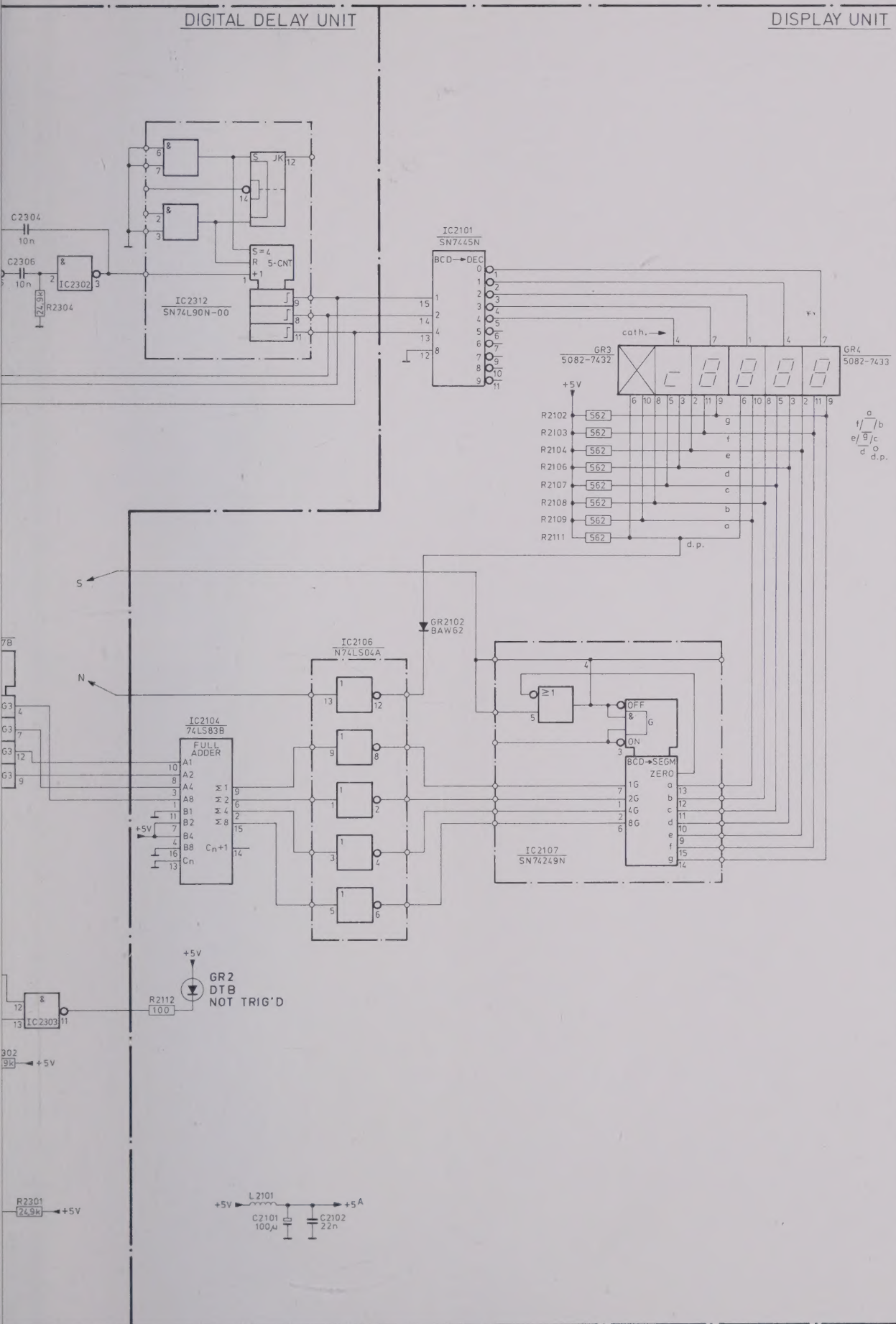


Fig. 3.5. Digital Delay Circuit Diagram

Sales and service all over the world

Alger: Sadetel; 41 Rue des Frères Mouloud Alger; tel. 656613-656607

Argentina: Philips Argentina S.A., Cassila Correo 3479, Buenos Aires; tel. T.E. 70, 7741 al 7749

Australia: Philips Electrical Pty Ltd., Philips House, 69-79 Clarence Street, Box 2703 G.P.O., Sydney; tel. 2.0223

België/Belgique: M.B.L.E., Philips Bedrijfs-apparatuur, 80 Rue des Deux Gares, Bruxelles; tel. 02/13.76 00

Bolivia: Industrias Bolivianas Philips S.A. LA Jón postal 2964 La Paz tel. 50029

Brasil: S.A. Philips Do Brasil; Avenida Paulista 2163; P.O. Box 8681; Sao Paulo S.P.; tel. 81-2161.

Burundi: Philips S.A.R.L., Avenue de Grèce, B.P. 900, Bujumbura

Canada: Philips Electronic Industries Ltd., Scientific and Electronic Equipment Division, Philips House, 116 Vanderhoof Avenue, Toronto 17 M 4G 2J1. tel. (416)-425-5161.

Chile: Philips Chilena S.A., Casilla 2687, Santiago de Chile; tel. 94001

Colombia: Industrias Philips de Colombia S.A., Calle 13 no. 51-03, Apartado Nacional 1505, Bogotá; tel. 473640

Costa Rica: Philips de Costa Rica Ltd., Apartado Postal 4325, San José; tel. 210111

Danmark: Philips Elektronik Systemer A/S Afd. Industri & Forskning; Strandlodsvej 4 2300-København S; Tel (0127) AS 2222; telex 27045

Deutschland (Bundesrepublik): Philips Elektronik Industrie GmbH, 35 Kassel-Bettenhausen, Miramstrasse 87; tel. (0561) 501521.

Ecuador: Philips Ecuador S.A., Casilla 343, Quito; tel. 239080

Egypt: Ph. Scientific Bureau 5 Sherif Str. Cairo - A.R. Egypt P.O. Box 1807; tel. 78457-57739

Eire: Philips Electrical (Ireland) Ltd., Newstead, Clonskeagh, Dublin 14; tel. 976611

El Salvador: Philips de El Salvador, Apartado Postal 865, San Salvador; tel. 217441

España: Philips Ibérica S.A.E., Avenida de America, Apartado 2065, Madrid 17; tel. 2462200

Ethiopia: Philips Ethiopia (Priv. Ltd. Co.), P.O.B. 2565; Cunningham Street, Addis Abeba; tel. 48300

Finland: Oy Philips Ab, Postboks 10255, Helsinki 10; tel. 10915

France: Philips Industrie, Division de la S.A. Philips Industrielle et Commerciale 105 Rue de Paris, 93 002 Bobigny; tel. 830-11-11

Ghana: Philips (Ghana) Ltd., P.O.B. M 14, Accra; tel. 66019

Great Britain: Pye Unicam Ltd., York Street, Cambridge; tel. (0223) 58866

Guatemala: Philips de Guatemala S.A., Apartado Postal 238, Guatemala City; tel. 64857

Hellas: Philips S.A. Hellénique, 54, Ave Syngrou, Athens; tel. 230476, P.O. Box 153

Honduras: Hasbun de Honduras Apartado Postal 83, Tegucigalpa; tel. 2-9121...5

Hong kong: Philips Hong Kong Ltd., P.O.B. 2108, St. George's Building, 21st floor, Hong Kong; tel. 5-249246

India: Philips India Ltd., Shivsagar Estate, Block "A", Dr. Annie Besant Road, P.O.B. 6598, Worli, Bombay 18; tel. 370071

Indonesia: P. T. Philips Development Corporation, Jalan Proklamasi 33, P.O.B. 2287, Jakarta; tel. 51985-51986

Iran: Philips Iran Ltd., P.O.B. 1297, Teheran; tel. 662281

Iraq: Philips Iraq W.L.L. Munir Abbas Building 4th Floor; South Gate. P.O. box 5749 Baghdad; tel. 80409

Island: Heimilistaeki SF, Saetún 8, Reykjavik; tel. 24000

Islas Canarias: Philips Ibérica S.A.E., Triana 132, Las Palmas; Casilla 39-41, Santa Cruz de Tenerife

Italia: Philips S.p.A., Sezione PIT; Viale Elvezia 2, 20052 Monza; tel. (039) 361-441; telex 35290

Kenya: Philips (Kenya) Ltd., P.O.B. 30554, Nairobi; tel. 29981

Malaysia: Philips Malaya Sdn Bhd. P.O. Box 332, Kuala Lumpur; Selangor W. Malaysia; tel. 774411

Mexico: Philips Comercial S.A. de C.V., Uruapan 7, Apdo 24-328, Mexico 7 D.F.; tel. 25-15-40

Nederland: Philips Nederland B.V., Boschdijk, Gebouw VB, Eindhoven; tel. 793333

Ned. Antillen: N.V. Philips Antillana, Postbus 523, Willemstad; tel. Curaçao 36222-35464

New Zealand: Philips Electronical Industries (N.Z.) Ltd., Professional and Industrial Division, 70-72 Kingsford Smith Street, P.O.B. 2097, Lyall Bay, Wellington; tel. 73-156

Nigeria: Philips (Nigeria) Ltd., 6 Ijora Causeway, P.O.B. 1921, Lagos; tel. 45414/7

Nippon: Nihon Philips Corporation, P.O.B. 13, World Trade Center, 32nd Floor, Tokyo 105; tel. (03) 435-5211

Norge: Norsk A.S. Philips, Postboks 5040, Oslo; tel. 463890

Österreich: Oesterreichische Philips Industrie GmbH, Abteilung Industrie Elektronik, Partargasse 32, A-1230 Wien; tel. (0222)-831501.

Pakistan: Philips Electrical Co. of Pakistan Ltd., El-Markaz, M.A. Jinnah Road, P.O.B. 7101, Karachi; tel. 70071

Paraguay: Philips del Paraguay S.A., Casilla de Correo 605, Asuncion; tel. 8045-5536-6666

Perú: Philips Peruana S.A., Apartado Postal 1841, Lima; tel. 326070

Philippines: Philips Industrial Development Inc., 2246 Pasong Tamo P.O.B. 911, Makati

Rizal D-708; tel. 889453 to 889456

Portugal: Philips Portuguesa S.A.R.L., Av. Eng.º Duarte Pacheco, 6 - Lisboa - 1

Rwanda: Philips Rwanda S.A.R.L., B.P. 449, Kigali

Saudi Arabia: A. Rajab and A. Silsilah P.O. box 203 Jeddah - Saudi Arabia; tel. 5113-5114

Schweiz-Suisse-Svizzera: Philips A.G., Binzstrasse 15, Postfach 8027, Zürich; tel. 051-442211

Singapore: Philips Singapore Private Ltd. P.O. Box 340; Toa Payoh Central Post Office; Singapore 12; tel. 538811

South Africa: South African Philips (Pty) Ltd., P.O.B. 7703, 2, Herb Street, New Doornfontein, Johannesburg; tel. 24-0531

Sverige: Svenska A.B. Philips, Fack, Lidingövägen 50, Stockholm 27; tel. 08/635000

Syria: Philips Moyen-Orient S.A. Rue Fardoss 79 Immeuble Kassas and Sadate B.P. 2442 Damas; tel. 18605-21650

Taiwan: Yung Kang Trading Co. Ltd., San Min Building, Gnd Floor, 57-1 Chung Shan N Road, 2 Section, P.O.B. 1467, Taipei; tel. 577281

Tanzania: Philips (Tanzania) Ltd., Box 20104, Dar es Salaam; tel. 29571

Thailand: Philips Thailand Ltd., 283, Silom Road, Bangkok; tel. 36980, 36984-9

Turkey: Türk Philips Ticaret A.S., Posta Kutusu 504, Beyoglu; Gümüssüyük Caddesi 78/80 Istanbul 1 Turkeye

Uganda: Philips Uganda Ltd. p.o. Box 5300 Kampala; tel. 59039

Uruguay: Industrias Philips del Uruguay, Avda Uruguay 1287, Montevideo; tel. 915641 Casilla de Correo 294

U.S.A.: Philips Test and Measuring Instruments Inc.; 400 Crossways Park Drive, Woodbury, N.Y. 11797; tel. (516) 921-8880

Venezuela: C.A. Philips Venezolana, Apartado Postal 1167, Caracas; tel. 360511

Zaire: Philips S.Z.R.L., B.P. 1798, Kinshasa; tel. 31887-31888-31693

Zambia: Philips Electrical Ltd., Professional Equipment Division, P.O.B. 553 Kitwe; tel. 2526/7/8; Lusaka P.O. Box 1878

760101

For information on change of address:

N.V. Philips
Test and Measuring Instruments Dept.
Eindhoven - The Netherlands

For countries not listed:

N.V. Philips PIT Export Dept.
Test and Measuring Instruments Dept.
Eindhoven - The Netherlands

